Application Form
Continuing Education Programme

University of Toronto
Division of University Extension
119 St. George Street
Toronto 181 Ontario
(416) 928-2400

OFFICE USE
Receipt No.

Course

Mr. Mrs. Miss

Name

Address

Number and Street

Telephone

Home

Company Name

Present Position

$ Cash

Fee

Personal Cheque

Date

Signature

Simulation and management modeling

This course is designed to serve as an introduction to the techniques of simulation for the potential practitioner and the interested manager. Simulation as considered here consists in the construction of an abstract mathematical model of the system to be studied and the subsequent numerical manipulation of the model in order to forecast the behaviour of the system under varied conditions. The manipulation may be carried out by hand or with computational equipment. Because of the extensive calculations involved in many simulations the work is generally done with electronic computers and special languages have been devised to facilitate application.

The course will begin with a discussion of the strengths and weaknesses of the technique. Models will be constructed and examined in relation to their applicability. The relevant statistical theory will be given along with discussion of the confidence that can be placed in the results and their validation. A brief review of the simulation languages will be presented. This will relate the basic concepts of random number generators, information storage and retrival, time flow mechanisms, data imput, output, and collection. Special simulation languages will be introduced and their use will be demonstrated with examples in GPSS, SIMSCRIPT, DYNAMO, GASPII, etc.

A knowledge of Grade 13 mathematics is desirable, and some previous familiarity with probability and statistics and with digital computers will be helpful.

Instructor R.W. P. Anderson, Associate Professor
Department of Industrial Engineering,
University of Toronto
I.B. Turksen, Assistant Professor,
Department of Industrial Engineering,
University of Toronto

Reference Emshoff, J.R. and Sisson, R.L. *Design and Use of Computer Simulation Models*, Macmillan, 1970
Rubinstein, J., *Computer Simulation Application*, Wiley & Sons, 1971

Time Thursday 7.00 - 9.30 pm

Place Room 316, Galbraith Building

Operational Research Certificate Programme

University of Toronto
Division of University Extension
Continuing Education Programme
1972 73

In co-operation with the
Canadian Operational Research Society

OPERATIONAL RESEARCH CERTIFICATE PROGRAMME

In co-operation with the Canadian Operational Research Society

This programme is designed to provide a familiarity with the variety of techniques used by practitioners in the field of operational research. It will give students an adequate background for advanced specialist studies and will give persons in supervisory and management positions a working appreciation of techniques used in daily applications of operational research. The level of the courses is that of advanced undergraduate and graduate university instruction. In recognition of the level of achievement, those successfully completing the programme will be granted a certificate by the Canadian Operational Research Society

Admission

Applicants for admission to the programme:
(a) must be able to meet the general admission requirements of the University of Toronto, or
(b) must be of mature age (23) with suitable experience and background in the fields covered by the programme.

An applicant must prove his qualifications for admission to the programme by submitting to the Division of University Extension:
(a) a copy of an official transcript from any Board of Education or University, or
(b) a copy of his birth certificate or driver's licence *and* a letter from his superior on company letterhead, outlining the employee's experience in the field.

Certificate

Candidates for the certificate:
(a) must attain a 'C' grade (60%) or better in at least 4 of the 6 courses and a pass in all of them, and
(b) must make application to the Canadian Operational Research Society

Registration

Students may register by mail or in person, by completing the attached application form. Fees must be paid in advance, and cheques or money orders should be made payable to the University of Toronto.

Dates (unless otherwise indicated)

Mondays	Sept. 25 – Dec. 18 plus Jan. 8	– Feb. 26
Tuesdays	Sept. 26 – Dec. 12 plus Jan. 9	– Feb. 27
Wednesdays	Sept. 27 – Dec. 13 plus Jan. 10	– Feb. 28
Thursdays	Sept. 28 – Dec. 14 plus Jan. 11	– Mar. 1

There will be no classes on October 9, Thanksgiving Day.

Location

St. George Campus, University of Toronto

Fees

All fees are $100.00 for 20 sessions unless otherwise indicated. Fees are not refundable after the second session. An administrative fee of $10.00 is charged for all refunds

Registration

For detailed information write or telephone:
Division of University Extension
119 St. George Street
Toronto 181, Ontario
(416) 928-2400

Courses

Students are advised to take 'Linear algebra and matrices' and 'Probability theory and mathematical statistics' before commencing the other courses

Linear algebra and matrices

This course consists of a study of matrix notions and operations, inversion, determinants, computational methods with matrices and determinants, systems of linear equations, vectors and vector spaces, eigen value problems, linear programming, linear models, the simplex method, and applications

Registration is limited to 50 participants.

Suggested minimum preparation Undergraduate engineering mathematics.

Instructor	A.H. Abdelmessih, Associate Professor, Department of Mechanical Engineering, University of Toronto
Text	Hadley G., *Linear Algebra*, Addison-Wesley, 1964
Time	Tuesdays 6.30 – 9.30 pm Sept. 5 – Dec. 19
Place	Room 243, Galbraith Building
Fee	$100.00 16 sessions

Linear programming and its extensions

This course is designed for engineers, operational researchers, and management scientists who wish to be able professionally to apply linear programming and related techniques. Although no previous experience with mathematical programming is required, it will be helpful, as will be a familiarity with matrices and linear algebra. This course will start from fundamentals and develop and consider in detail such topics as the simplex method, the revised-simplex, the dual-simplex, activity analysis, price relationships, simple and generalized transportation problems, allocation problems, capacitated transportation problems, flows through networks, and branch and bound techniques.

Primal-dual programming problems and [illegible] cases of stochastic and integer programming will be treated. A brief introduction to non linear and dynamic programming will be included. Although emphasis will be placed upon methods of setting up and solving problems, these problems will be related to specific applications and case studies in the literature.
Registration is limited to 35 participants

Instructor	J.W. Abrams, Professor, Department of Industrial Engineering; Director, Institute of History and Philosophy of Science and Technology, University of Toronto
Text	Dantzig, G.B., *Linear Programming and it Extensions*, Princeton University Press, 1965
Time	Mondays 6.30 – 9.00 pm
Place	Room 316, Galbraith Building

Probability theory and mathematical statistics

This course offers a systematic introduction to modern probability theory and mathematical statistics, and is intended for engineers and practitioners in operational research. It is designed to form a rigorous background for those who desire a thorough course as a preliminary to undertaking advanced work in industrial engineering, operational research, or management science. Subjects to be covered include sample spaces, random variables, probability distributions, characteristic functions, sampling, theory of estimation, regression, and elements of analysis of variance. Familiarity with algebra and the calculus is required.

Instructor	B. Bernholtz, Professor and Chairman, Department of Industrial Engineering, University of Toronto
Text	Freund, J., *Mathematical Statistics*, Prentice-Hall, 1971
Time	Wednesdays 6.30 – 9.00 pm
Place	Room 310, Mechanical Building

Introduction to stochastic processes

This course is designed for engineers, operational researchers and management scientists who wish to acquire a working knowledge of the types of probabilistic models which are currently being applied to problems of business and engineering.

The course will contain a brief review of probability theory, classification of probabilistic models, and a discussion of Markov Processes in discrete and continuous time and space. An introduction to non-Markov Processes will be given. Some consideration will be given to statistical inference and computer simulation in stochastic models. Random walk and queuing models will be discussed.

Applications include [illegible] ment reliability, inventory management, storage and maintenance.
Registration is limited to 35 participants

Suggested minimum preparation Course 'Probability theory and mathematical statistics' or an equivalent course, mathematical maturity, at the level expected of an engineering graduate. Some aquaintance with operational research procedures is desirable.

Instructor	J.G.C. Templeton, Associate Professor Department of Industrial Engineering, University of Toronto
Text	Bhat, U. N., *Elements of Applied Stochastic Processes*, Wiley & Sons, 1972
Reference	Parzen, E., *Stochastic Processes*, Holden-Day, 1962 Panico, J.A., *Queuing Theory*, Prentice Hall, 1969
Time	Tuesdays 6.00 – 8.30 pm
Place	Room 310, Mechanical Building

Statistical decision theory

The course is intended to provide a thorough introduction to the application of mathematical concepts and techniques to problems of decision-making. As such, the course is of particular interest to engineers, operational researchers, and management scientists. Familiarity with the methods of probability and statistics, such as is acquired through an introductory course, is an essential prerequisite, as is calculus. A knowledge of linear algebra, although not essential, would also be very helpful. In any event, the course will begin with a statement and brief review of those elements of these topics to be used throughout the course.

The course will then proceed to develop the mathematical theory of decision making via such component concepts as utility, uncertainty, criteria of choice, experiment and information, etc. Emphasis will be placed throughout the course on practical considerations of implementing the theory and on computational schemes. Specific applications will be discussed in the areas of medicine, marketing, quality control, production planning, and classical statistics.

Instructor	A.A. Cunningham, Assistant Professor, Department of Industrial Engineering, University of Toronto
Reference	Weiss, L., *Statistical Decision Theory*, McGraw-Hill, 1961 Schlaiffer, F., *Analysis of Decision under Uncertainty*, McGraw-Hill, 1969 De Groot, M., *Optimal Statistical Decisions*, McGraw-Hill, 1970
Time	Thursdays 6.00 – 8.00 pm
Place	Room 204, Galbraith Building